REMARKS/ARGUMENTS

Claims 18 and 20-26 are pending in this application.

Claims 18 and 20-26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lutjering et al. ("Titanium").

Applicant respectfully traverses the rejection of claims 18 and 20-26.

Claim 18 recites:

> **A titanium alloy part having a compressive stress of approximately 270 MPa or more within a depth of about 100 μm from a surface thereof**; wherein
> a surface region extends from the surface to a depth of about 100 μm, and an internal region is disposed internally relative to the surface region; and
> **the surface region includes a modified layer containing more α phase than does the internal region, the modified layer accounting for a proportion of about 10 vol% or less of the surface region.** (emphasis added)

The Examiner alleged that Lutjering et al. teaches that surface damage such as nicks, scratches, gouges, or abusive machining in the surface of a titanium part create the risk of unforeseen fatigue failure and that "presumably one of ordinary skill in the art would reasonably remove these layers by polishing, chemical milling, or any other appropriate surface removal/smoothing technique to yield a smooth surface free of crack initiation sites" (see the first full paragraph on page 3 of the Office Action). Applicant respectfully disagrees.

In section 3.7.1 on page 114 of Lutjering et al., upon which the Examiner relied to support the allegation that it would have been obvious to remove the damaged surface layers, Lutjering et al. teaches:

> Inadvertent introduction of surface damage (nicks, scratches, gouges or abusive machining) can affect the conversatism of these curves creating unforeseen risk of fatigue failure. **The beneficial effects of shot peening more than compensate for the presence of surface damage** and, therefore, can be thought as introducing a "safety net" with respect to fatigue, **provided the damage is not too severe or too deeply embedded**. (emphasis added)

As clearly seen from the above teaching of Lutjering et al., shot peening more

than compensates for the presence of surface damage such that one of ordinary skill in would readily understand that the presence of surface damage is acceptable to a certain degree. Although Lutjering et al. cautions that the surface damage should not be too severe or too deeply embedded, there is no teaching or suggestion in Lutjering et al. that polishing or chemical milling, such as that disclosed in section 3.7.3 of Lutjering et al., could or should be performed after shot peening to remove *severe or deeply embedded* surface damage. Applicant respectfully submits that one of ordinary skill in the art would not employ polishing or chemical milling to remove *severe or deeply embedded* surface damage as polishing and chemical milling are known to be superficial surface treatments that cannot remove the severe or deeply embedded surface damage contemplated by Lutjering et al.

The Examiner alleged that "Lutjering et al. also teaches that chemical milling is used to remove contaminated material from the surface of titanium parts, such as oxide layers" (see the second full paragraph on page 3 of the Office Action). The Examiner further alleged that although Lutjering et al. teaches that chemically milled surfaces are often shot peened to create or restore surface residual stress, "this teaching operates on the assumption that peening will not introduce this same class of defects" (see again the second full paragraph on page 3 of the Office Action). Applicant respectfully disagrees.

First, as acknowledged by the Examiner in the second full paragraph on page 3 and the second full paragraph on page 6 of the Office Action, Lutjering et al. teaches that chemical milling is a process used to remove material that has become contaminated "for example, by oxygen, during processing" (see, for example, the first full paragraph on page 114 of Lutjering et al.). In section 3.7.3 on pages 121-122, Lutjering et al. teaches that chemical milling is a common way to selectively remove material from the surface of a component "to create an array of features," e.g., a waffle pattern to impart stiffness. Nowhere does not Lutjering et al. teach or suggest that chemical milling should be performed after shot peening to reduce surface damage.

Second, on the one hand, if the shot peening does not introduce the same class

of surface defects or damage alleged by the Examiner, one of ordinary skill in the art would not subsequently chemically mill the shot peened surface since there is no surface damage that should be removed. In this circumstance, the modified layer containing more α phase of the titanium due to the shot peening would extend much farther into the surface region of the titanium and clearly NOT account for a proportion of about 10 vol% or less of the surface region, as recited in Applicant's claim 18.

On the other hand, if the shot peening does introduce the same class of surface defects or damage alleged by the Examiner, and assuming *arguendo* that one of ordinary skill in the art would subsequently chemically mill the shot peened surface, Lutjering et al. clearly teaches that the chemically milled surface should be shot peened to restore the surface residual compressive stress. According to the Examiner, chemical milling should be performed whenever the shot peening introduces surface defects or damage, and shot peening should be last the step in the process only if no surface defects or damage are introduced during this shot peening step.

Thus, in view of the above allegations by the Examiner and the emphasis by Lutjering et al. that shot peening should be performed after chemical milling to create or restore the surface residual compressive stress, any step of chemical milling should be followed by a step of shot peening until the shot peening does not introduce any surface defects or damage. Thus, the last step will ALWAYS be shot peening in which the modified layer, which contains more α phase of the titanium due to the shot peening, extends much farther into the surface region of the titanium and clearly NOT account for a proportion of about 10 vol% or less of the surface region, as recited in Applicant's claim 18.

Lastly, the Examiner alleged that "it would have been obvious to one of ordinary skill in the art at the time of the invention to choose the instantly claimed ranges through process optimization, since it has been held that [w]here the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art" (see, for example, the paragraph bridging pages 3 and 4 of the Office Action). Applicant respectfully disagrees.

As set forth in MPEP § 2144.05(II)(B), a particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). Lutjering et al. discloses in Fig. 3.62 the depth (μm) of the residual compressive stress obtained by four different shot peening pressures. Lutjering et al. does not disclose anything at all about a modified layer containing more α phase of the titanium than an internal region of a titanium part, and certainly does not teach that the vol% of the modified layer in the surface region is a result effective variable which achieves a recognized result. Since Lutjering et al. fails to recognize that the vol% of the modified layer in the surface region is a result-effective variable, Applicant respectfully submits that it would not have been obvious to one of ordinary skill in the art to optimize the depth of the modified layer such that the modified layer accounts for a proportion of about 10 vol% or less of the surface region, as recited in Applicant's claim 18.

Therefore, the Examiner has failed to establish a prima facie case of obviousness of the claimed invention because all the claim features must be taught or suggested by the prior art. See In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974) and MPEP § 706.02(j) and § 2143.03.

Thus, Lutjering et al. clearly fails to teach or suggest the features of "A titanium alloy part having a compressive stress of approximately 270 MPa or more within a depth of about 100 μm from a surface thereof" and "the surface region includes a modified layer containing more α phase than does the internal region, the modified layer accounting for a proportion of about 10 vol% or less of the surface region," as recited in Applicant's claim 18.

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of claim 18 under 35 U.S.C. § 103(a) as being unpatentable over Lutjering et al.

In view of the foregoing remarks, Applicant respectfully submits that claim 18 is

allowable. Claims 20-26 depend upon claim 18, and are therefore allowable for at least the reasons that claim 18 is allowable.

In view of the foregoing remarks, Applicant respectfully submits that this application is in condition for allowance. Favorable consideration and prompt allowance are solicited.

The Commissioner is authorized to charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 50-1353.

Respectfully submitted,

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